

Section I. (Amendments to the Claims)

Please amend claim 14, as set out below in the listing of claims 1-34 of the application.

1. (Withdrawn) A method of controlling copper electrochemical deposition in an electrochemical deposition system in which a wafer is contacted with an electrochemical deposition medium including at least one organic additive, wherein the electrochemical deposition medium has a plating anode in contact therewith to effect plating of copper on the wafer, and the electrochemical deposition is characterizable by at least one dependent variable correlative of efficacy of the copper electrochemical deposition, said method comprising:

selecting at least one dependent variable correlative of efficacy of the copper electrochemical deposition;

performing a regression analysis or multivariate calibration modeling of the copper electrochemical deposition utilizing a wafer-based independent variable to generate a dependent variable equation for each selected dependent variable correlative of efficacy of the copper electrochemical deposition;

solving the dependent variable equation for each selected dependent variable correlative of efficacy of the copper electrochemical deposition, by regression analysis, to yield a solution value for each selected dependent variable; and

modulating the copper electrochemical deposition in response to the solution value for each selected dependent variable.

2. (Withdrawn) The method of claim 1, wherein the wafer-based independent variable is selected from the group consisting of plating voltage output, plating current, electrode size, and wafer preconditioning pulse.

3. (Withdrawn) The method of claim 1, wherein the electrochemical deposition medium includes a copper salt and an inorganic acid.

4. (Withdrawn) The method of claim 3, wherein the inorganic acid comprises sulfuric acid.
5. (Withdrawn) The method of claim 3, wherein the copper salt comprises copper sulfate.
6. (Withdrawn) The method of claim 1, wherein the at least one organic additive includes an organic additive selected from the group consisting of organic accelerators, organic suppressors and organic levelers.
7. (Withdrawn) The method of claim 6, wherein the at least one organic additive includes an organic accelerator, and organic suppressor and an organic leveler.
8. (Withdrawn) The method of claim 1, wherein the electrochemical deposition medium further includes a chloride source.
9. (Withdrawn) The method of claim 1, wherein the selected at least one dependent variable includes concentration of at least one component of the electrochemical deposition medium.
10. (Withdrawn) The method of claim 9, wherein the selected at least one dependent variable includes concentration of an organic additive of the electrochemical deposition medium.
11. (Withdrawn) The method of claim 9, wherein the selected at least one dependent variable includes concentration of each organic additive in the electrochemical deposition medium.
12. (Withdrawn) The method of claim 9, wherein the selected at least one dependent variable includes concentration of at least one organic additive in the electrochemical deposition medium.

13. (Withdrawn) The method of claim 7, wherein the selected at least one dependent variable includes concentration of each organic accelerator, and organic suppressor and an organic leveler.

14. (Currently amended) Apparatus for controlling copper electrochemical deposition in an electrochemical deposition system in which a wafer is contacted with an electrochemical deposition medium including at least one organic additive, wherein the electrochemical deposition medium has a plating anode in contact therewith to effect plating of copper on the wafer, and the electrochemical deposition is characterizable by at least one dependent variable correlative of efficacy of the copper electrochemical deposition, said apparatus comprising:

a computational module constructed and arranged to perform the following steps:

selecting at least one dependent variable correlative of efficacy of the copper electrochemical deposition;

performing a regression analysis or multivariate calibration modeling of the copper electrochemical deposition utilizing a wafer-based independent variable to generate a dependent variable equation for each selected dependent variable correlative of efficacy of the copper electrochemical deposition; and

solving the dependent variable equation for each selected dependent variable correlative of efficacy of the copper electrochemical deposition, by regression analysis, to yield a solution value for each selected dependent variable;

said computational module being adapted for coupling in signal processing, monitoring and control relationship with the electrochemical deposition system when said electrochemical deposition system is arranged with the wafer being plated constituting a cathode element of an electrochemical cell including said copper plating anode, and said computational module being arranged to process an electrode parameter of said wafer as said wafer-based independent variable in said regression analysis; and

a control assembly adapted to modulate the copper electrochemical deposition in response to the solution value for each selected dependent variable.

15. (Original) Apparatus according to claim 14, wherein the wafer-based independent variable is selected from the group consisting of plating voltage output, plating current, electrode size, and wafer preconditioning pulse.

16. (Original) Apparatus according to claim 14, wherein the electrochemical deposition medium includes a copper salt and an inorganic acid.

17. (Original) Apparatus according to claim 16, wherein the inorganic acid comprises sulfuric acid.

18. (Original) Apparatus according to claim 16, wherein the copper salt comprises copper sulfate.

19. (Original) Apparatus according to claim 14, wherein the at least one organic additive includes an organic additive selected from the group consisting of organic accelerators, organic suppressors and organic levelers.

20. (Original) Apparatus according to claim 19, wherein the at least one organic additive includes an organic accelerator, and organic suppressor and an organic leveler.

21. (Original) Apparatus according to claim 14, wherein the electrochemical deposition medium further includes a chloride source.

22. (Original) Apparatus according to claim 14, wherein the selected at least one dependent variable includes concentration of at least one component of the electrochemical deposition medium.

23. (Original) Apparatus according to claim 22, wherein the selected at least one dependent variable includes concentration of an organic additive of the electrochemical deposition medium.

24. (Original) Apparatus according to claim 22, wherein the selected at least one dependent variable includes concentration of each organic additive in the electrochemical deposition medium.

25. (Original) Apparatus according to claim 22, wherein the selected at least one dependent variable includes concentration of at least one organic additive in the electrochemical deposition medium.

26. (Original) Apparatus according to claim 20, wherein the selected at least one dependent variable includes concentration of each organic accelerator, and organic suppressor and an organic leveler.

27. (Previously presented) Apparatus according to claim 20, wherein said control assembly adapted to modulate the copper electrochemical deposition in response to the solution value for each selected dependent variable, comprises components selected from the group consisting of: variable output power supplies arranged to supply power to the electrochemical deposition system; and variable flow control valves for modulating flow to the electrochemical deposition medium of one or more components of the electrochemical deposition medium.

28. (Previously presented) Apparatus according to claim 27, wherein said control assembly comprises a variable output power supply arranged to supply power to the electrochemical deposition system.

29. (Previously presented) Apparatus according to claim 27, wherein said control assembly comprises variable flow control valves for modulating flow to the electrochemical deposition medium of one or more components of the electrochemical deposition medium.

30. (Original) Apparatus according to claim 29, wherein the variable flow control valves are respectively coupled with sources of accelerator, leveler and suppressor.

31. (Previously presented) Apparatus according to claim 14, operatively coupled with said electrochemical deposition system to control copper electrochemical deposition therein.

32. (Previously presented) Apparatus according to claim 31, wherein said electrochemical deposition system comprises a wafer as an electrode component of an electrochemical cell.

33. (Previously presented) Apparatus according to claim 32, wherein said at least one dependent variable comprises a wafer-based electrode parameter.

34. (Previously presented) Apparatus according to claim 33, wherein said wafer-based electrode parameter comprises a parameter selected from the group consisting of plating voltage output, plating current, electrode size, cathode preconditioning pulse current, and cathode preconditioning pulse voltage.